Claims

[c1] 1. An optical pickup apparatus for reading information on a rotating optical medium, comprising:
a light source adapted to direct two beams of light onto adjacent locations on a track of said optical medium;
first and second optical sensors positioned to detect reflection of said beams of light from said optical medium and to produce a leading electrical signal and a lagging electrical signal, respectively,
wherein said leading electrical signal is delayed to at least partially coincide with said lagging electrical signal; and wherein said delayed leading electrical signal is combined with said lagging electrical signal to produce a resultant electrical signal in response to the overlap between said delayed leading electrical signal with said lagging electrical signal.

[c2] 2. An apparatus as recited in claim 1, wherein said light source comprises:
a laser light source capable of outputting a laser light beam;
a diffraction grating configured to split said light beam into a central read beam and a peripheral tracking beam;
an optical mechanism configured to split said read beam tangentially along said track into two separate read beams; and
an objective configured to focus said separate read beams onto nearby locations within said track.

[c3] 3. The apparatus as recited in claim 2, wherein said optical mechanism comprises a BLAZE grating.

[c4] 4. An apparatus as recited in claim 2, further comprising:
a beam splitter positioned between said optical mechanism and said objective;
wherein said beam splitter directs a portion of the optical energy from all of said beams toward said objective; and
wherein said beam splitter is optically coupled to the reflection of all of said beams, a portion of the optical energy of which is directed for registration.

[c5] 5. An apparatus as recited in claim 1, wherein said optical sensors comprise photo sensitive arrays.

[c6] 6. An apparatus as recited in claim 5, wherein said photosensitive arrays comprise photodiodes.

[c7] 7. An apparatus as recited in claim 1, wherein said leading electrical signal is delayed by an amount that is based on a linear speed of said medium, a distance between said adjacent locations, and a selected amount of waveform coincidence.

[c8] 8. An apparatus as recited in claim 1, wherein an electronic delay circuit is adapted to delay said leading electrical signal and output an electrical signal as a temporally shifted received electrical signal.

[c9] 9. An apparatus as recited in claim 8, wherein an amount of temporal shift created by said electronic delay circuit is variable.

[c10] 10. An apparatus as recited in claim 9, wherein said amount of temporal shift is responsive to the receipt of a delay selection input.

[c11] 11. An apparatus as recited in claim 1, wherein a multiplier circuit is used to combine said leading and lagging electrical signals, which outputs a resultant electrical signal in response to the overlap of the delayed leading electrical signal with the lagging electrical signal.

[c12] 12. An apparatus as recited in claim 1, wherein said leading electrical signal is delayed to at least partially coincide with said lagging electrical signal by a delay circuit configured to delay the leading signal by a selected amount received by a delay circuit input.

[c13] 13. An apparatus as recited in claim 1, wherein said delayed leading electrical signal is combined with said lagging electrical signal using a multiplier circuit to produce a resultant electrical signal.

[c14] 14. An optical pickup apparatus for reading information on a rotating optical medium, comprising:
a light source adapted to direct two beams of light onto adjacent locations on a track of said optical medium;
first and second optical sensors positioned to detect reflection of said beams of

light from said optical medium and to produce a leading electrical signal and a lagging electrical signal, respectively;
said leading and lagging electrical signals being proportional to an amount of light detected within each beam;
a delay circuit adapted to delay said leading electrical signal to at least partially coincide with said lagging electrical signal; and
means for combining said delayed leading electrical signal with said lagging electrical signal to produce a combined electrical signal in response to the overlap
between said delayed leading electrical signal with said lagging electrical signal.

[c15] 15. An apparatus as recited in claim 14, wherein said light source comprises:
a laser light source capable of outputting a laser light beam;
a diffraction grating configured to split said light beam into a central read beam and a peripheral tracking beam;
an optical mechanism configured to split said read beam tangentially along said track into two separate read beams; and
an objective configured to focus said separate read beams onto nearby locations within said track.

[c16] 16. The apparatus as recited in claim 15, wherein said optical mechanism comprises a BLAZE grating.

[c17] 17. An apparatus as recited in claim 15, further comprising:
a beam splitter positioned between said optical mechanism and said objective;
wherein said beam splitter directs a portion of the optical energy from all of said beams toward said objective; and
wherein said beam splitter is optically coupled to the reflection of all of said beams, a portion of the optical energy of which is directed for registration.

[c18] 18. An apparatus as recited in claim 14, wherein said optical sensors comprise photosensitive arrays.

[c19] 19. An apparatus as recited in claim 18, wherein said photosensitive arrays comprise photodiodes.

[c20] 20. An apparatus as recited in claim 14, wherein said delay circuit is adapted to delay said leading electrical signal by an amount that is based on a linear speed of said medium in relation to the reading means, a distance between said adjacent locations, and a selected amount of waveform coincidence.

[c21] 21. An apparatus as recited in claim 14, wherein said delay circuit comprises an electronic delay circuit adapted to output an electrical signal as a temporally shifted received electrical signal.

[c22] 22. An apparatus as recited in claim 21, wherein an amount of temporal shift created by said electronic delay circuit is variable.

[c23] 23. An apparatus as recited in claim 22, wherein said amount of temporal shift is responsive to the receipt of a delay selection input.

[c24] 24. An apparatus as recited in claim 14, wherein said combining means comprises a multiplier circuit which outputs a resultant electrical signal in response to the overlap of the delayed leading electrical signal with the lagging electrical signal.

[c25] 25. An apparatus as recited in claim 14, wherein said means for combining said delayed leading electrical signal with said lagging electrical signal to produce a combined electrical signal comprises a multiplier circuit.

[c26] 26. An optical pickup apparatus for reading information on a rotating optical medium, comprising:
means for optically reading adjacent optically encoded positions along a track of said rotating optical medium and generating a leading and lagging electrical signal in response thereto;
means for delaying said leading electrical signal to at least partially coincide with said lagging electrical signal; and
means for combining said delayed leading electrical signal with said lagging electrical signal to produce a combined electrical signal in response to the overlap
between said delayed leading electrical signal with said lagging electrical signal.

[c27] 27. An apparatus as recited in claim 25, wherein said optical reading means comprises:
a light source adapted to direct two beams of light onto adjacent locations on said track; and
two optical sensors positioned to detect the reflection of said beams of light and to produce a leading electrical signal and a lagging electrical signal which are proportional to an amount of light detected within each beam.

[c28] 28. An apparatus as recited in claim 27, wherein said light source comprises:
a laser light source capable of outputting a laser light beam;
a diffraction grating configured to split said light beam into a central read beam and a peripheral tracking beam;
an optical mechanism configured to split said read beam tangentially along said track into two separate read beams; and
an objective configured to focus said separate read beams onto nearby locations within said track.

[c29] 29. The apparatus as recited in claim 28, wherein said optical mechanism comprises a BLAZE grating.

[c30] 30. An apparatus as recited in claim 28, further comprising:
a beam splitter positioned between said optical mechanism and said objective;
wherein said beam splitter directs a portion of the optical energy from all of said beams toward said objective; and
wherein said beam splitter is optically coupled to the reflection of all of said beams, a portion of the optical energy of which is directed for registration.

[c31] 31. An apparatus as recited in claim 27, wherein said optical sensors comprise photosensitive arrays.

[c32] 32. An apparatus as recited in claim 31, wherein said photosensitive arrays comprise photodiodes.

[c33] 33. An apparatus as recited in claim 26, wherein said delaying means is adapted to delay said leading electrical signal by an amount that is based on a linear speed of said optical medium in relation to the reading means, a distance

between said adjacent encoded positions, and a selected amount of waveform coincidence.

[c34] 34. An apparatus as recited in claim 26, wherein said delaying means comprises an electronic delay circuit adapted to output an electrical signal as a temporally shifted received electrical signal.

[c35] 35. An apparatus as recited in claim 34, wherein an amount of temporal shift created by said electronic delay circuit is adjustable.

[c36] 36. An apparatus as recited in claim 35, wherein said amount of temporal shift is responsive to the receipt of a delay selection input.

[c37] 37. An apparatus as recited in claim 26, wherein said combining means comprises a multiplier circuit adapted to output an electrical signal in response to the overlap of the delayed leading electrical signal with the lagging electrical signal.

[c38] 38.An apparatus as recited in claim 24, wherein said means for optically reading adjacent optically encoded positions along said track and generating a leading and lagging electrical signal in response thereto, comprises:

first and second photodetectors positioned to detect light beams reflected from said optical medium;

said first photodetector positioned to detect a lagging light beam;

said second photodetector positioned to detect a leading light beam;

circuitry configured to generate a lagging electrical signal; and

circuitry configured to generate a leading electrical signal.

[c39] 39. An apparatus as recited in claim 26, wherein said means for delaying said leading electrical signal to at least partially coincide with said lagging electrical signal comprises a delay circuit configured to delay the leading signal by a selected amount received by a delay circuit input.

[c40] 40. An apparatus as recited in claim 26, wherein said means for combining said delayed leading electrical signal with said lagging electrical signal to produce a combined electrical signal comprises a summing circuit.

[c41] 41.An optical pickup apparatus for reading information located on rotating optical medium, comprising:

a light source adapted to direct two beams of light onto adjacent locations on a track of said optical medium,

a first and a second optical sensor positioned to detect a reflection of said beams of light from said optical medium and to produce a leading electrical signal and a lagging electrical signal, respectively;

said leading and lagging electrical signals being proportional to an amount of light detected within each beam; a delay circuit adapted to delay said leading electrical signal to at least partially coincide with said lagging electrical signal; and

a summing circuit adapted to combine said delayed leading electrical signal with said lagging electrical signal to produce a combined electrical signal in response to the overlap between said delayed leading electrical signal with said lagging electrical signal.

[c42] 42. An apparatus as recited in claim 41, wherein said light source comprises:

a laser light source capable of outputting a laser light beam;

a diffraction grating configured to split said light beam into a central read beam and a peripheral tracking beam;

an optical mechanism configured to split said read beam tangentially along said track into two separate read beams, and

an objective configured to focus said separate read beams onto nearby locations within said track.

[c43] 43. The apparatus as recited in claim 42, wherein said optical mechanism comprises a BLAZE grating.

[c44] 44. An apparatus as recited in claim 42, further comprising:

a beam splitter positioned between said optical mechanism and said objective;

wherein said beam splitter directs a portion of the optical energy from all of said beams toward said objective; and

wherein said beam splitter is optically coupled to the reflection of all of said beams, a portion of the optical energy of which is directed for registration.

[c45] 45. An apparatus as recited in claim 41, wherein said optical sensors comprise photosensitive arrays.

[c46] 46. An apparatus as recited in claim 45, wherein said photosensitive arrays comprise photodiodes.

[c47] 47. An apparatus as recited in claim 41, wherein said delay circuit is adapted to delay said leading electrical signal by an amount that is based on the linear speed of said medium in relation to the reading means, a distance between the two reading means, and a selected amount of waveform coincidence.

[c48] 48. An apparatus as recited in claim 41, wherein said delay circuit comprises an electronic delay circuit adapted to output an electrical signal as a temporally shifted received electrical signal.

[c49] 49. An apparatus as recited in claim 48, wherein an amount of temporal shift created by said electronic delay circuit is adjustable.

[c50] 50. An apparatus as recited in claim 49, wherein said amount of temporal shift is responsive to the receipt of a delay selection input.

[c51] 51. An apparatus as recited in claim 41, wherein said summing circuit comprises a multiplier circuit which outputs an electrical signal in response to the overlap of the delayed leading electrical signal with the lagging electrical signal.

[c52] 52. An apparatus as recited in claim 41, wherein said delay circuit is adapted to delay the leading signal by a selected amount received by a delay circuit input.

[c53] 53. An optical pickup capable of reading data along at least one of a plurality of tracks located on a rotating information plane of an optical medium which provides an electrical modulation of an effective spot size of a read beam, comprising:

means for sensing optical information on a track, said optical information sensing means capable of generating a first electrical signal and a temporally lagging

second electrical signal in response to the data encoded on said track;

a delay circuit which introduces a temporal delay into said first electrical signal so that it at least partially coincides with said second electrical signal; and

a multiplier circuit which receives and combines said first and said second electrical signals to output a third electrical signal related to the coincidence between

the delayed first electrical signal and said second electrical signal;

whereby the effective spot size of the read beam may be varied in response to an amount of coincidence created as a result of the delay introduced into said first

electrical signal.

[c54] 54. An optical pickup as recited in claim 53, wherein said means for sensing optical information comprises

at least one laser light source adapted to direct two beams of light toward adjacent locations along said track of said medium; and

two optical detectors positioned to receive and register reflected light of said beams from said medium and to generate electrical signals in response thereto.

[c55] 55. An optical pickup as recited in claim 54, wherein said laser light source comprises:

a laser light source capable of outputting a single laser light beam;

a diffraction grating positioned to receive and split said laser light beam into a central read beam and a peripheral tracking beam;

an optical mechanism positioned to receive said central read beam, wherein said read beam is split into two separate read beams for direction along said track; and

an objective positioned to receive said separate read beams and to focus said beams onto nearby locations within said track.

[c56] 56. The optical pickup as recited in claim 55, wherein said optical mechanism comprises a BLAZE grating.

[c57] 57. An optical pickup as recited in claim 55, further comprising:

a beam splitter positioned between said optical mechanism and said objective;

wherein said beam splitter directs a portion of the optical energy from all of

said beams toward said objective; and

wherein said beam splitter is positioned to receive the reflection of said beams, a portion of the optical energy of which is directed for registration.

[c58] 58. An optical pickup as recited in claim 57, wherein said optical detectors comprise photosensitive arrays.

[c59] 59. An optical pickup as recited in claim 58, wherein said photosensitive arrays comprise photodiodes.

[c60] 60. An optical pickup as recited in claim 53, wherein said temporal delay of said delay circuit is selected based on the relative velocity of said medium in relation to said optical information sensing means and a distance between said first spot and said second spot with respect to said track of said optical medium.

[c61] 61.An optical pickup as recited in claim 53, wherein an amount of temporal delay introduced by said delay circuit within said first electrical signal is variable.

[c62] 62. An optical pickup as recited in claim 61, wherein said amount of temporal delay of said delay circuit is responsive to the receipt of a delay selection input.

[c63] 63.An optical pickup as recited in claim 62, wherein an effective diameter associated with said third electrical signal output by said multiplier circuit is selected by varying an amount of said delay; and

wherein said effective diameter associated with said third electrical signal ranges between zero, when said first and said second signal do not temporally coincide, up to the diameter of the smaller of said first and said second spots when said first and said second signals fully temporally coincide.

[c64]

64. An apparatus for reading information on an information plane of an optical medium, comprising:

a first read beam forming a first spot on a track located on said optical medium;

a second read beam forming a second spot on the track;

wherein said second spot is located proximate said first spot;

a first photodetector for receiving a reflected portion of said first spot resulting

in a first electrical signal;
a second photodetector for receiving a reflected portion of said second spot resulting in a second electrical signal, said first and said second electrical signals having a time delay therebetween based on a relative velocity and a distance between the first spot and the second spot with respect to the surface of the optical medium, the second being earlier in time than the first electrical signal;
an adjustable time delay element coupled to an output of said second photodetector for delaying said second electrical signal by a predetermined value; and
a coincidence handling element for merging said first electrical signal with said delayed second electrical signal according to a predetermined value to produce a third electrical signal corresponding to a third spot having an effective diameter less than the diameters of said first and second spots, said third spot diameter being varied by adjusting the time delay element.

[c65] 65. An apparatus as recited in claim 64, wherein said coincidence handling element comprises a multiplier which multiplies said first electrical signal by said delayed second electrical signal.

[c66] 66. An apparatus as recited in claim 64, wherein said coincidence handling element comprises a divider which divides said first electrical signal by said delayed second electrical signal.

[c67] 67. An apparatus as recited in claim 64, wherein said photodetectors are configured within an array.

[c68] 68. An apparatus as recited in claim 67, wherein said photodetector array comprise photodiodes.

[c69] 69. An apparatus as recited in claim 64, wherein said adjustable time delay element comprises an electronic delay circuit having a selected propagation delay.

[c70] 70. A method of altering the effective beam spot size for use in reading data on an optical medium, comprising:

amplifying the electrical coincidence of optically separate signals read along a track of said optical medium that have been differentially delayed electronically to at least partially coincide with one another, wherein an amount of coincidence determines the effective beam spot size.

[c71] 71. A method of electronically adjusting the effective beam spot size of an optical pickup when reading data bits optically encoded within a track of an optical medium subject to rotational movement, comprising:
impinging a first and second beam onto a selected track of said optical medium, wherein said first beam is nearby, and temporally precedes, said second beam;
detecting the reflections of said first and said second beams from said optical medium;
generating first and second electrical signals in response to the detected reflections of said first and said second beams;
delaying said first electrical signal in relation to said second electrical signal;
wherein the waveform represented in said first electrical signal and said second electrical signal in response to the reflection of an identical data bit along said track is brought into at least partial temporal coincidence; and
combining said delayed first electrical signal with said second electrical signal, and
outputting a third electrical signal therefrom having a waveform in response to the reflection of a single data bit whose effective spot size is determined by an amount of coincidence between the waveforms represented by said delayed first waveform and said second waveform as determined by an amount of delay introduced in said second electrical signal, and the distance between said first and second beam spots, and the speed of said medium.

[c72] 72. An apparatus for reading information encoded on a surface of an optical medium comprising:
(a)an optical pickup for generating a first read beam and a second read beam, said first read beam forming a first spot on a track and
said second read beam forming a second spot on the track, wherein said second spot is proximate to said first spot, and said track is located on said surface of said optical medium;

(b)a first photodetector for receiving a reflected portion of the first spot and resulting in a first electrical signal;
(c)a second photodetector for receiving a reflected portion of the second spot resulting in a second electrical signal, the first and second electrical signals having a time delay therebetween based on a relative velocity and distance between the first spot and the second spot with respect to the surface of the optical medium, said second electrical signal being earlier in time than said first electrical signal;
(d)a time delay element coupled to an output of said second photodetector for delaying said second electrical signal by a predetermined value,thereby resulting in a delayed second electrical signal, and
(e)a multiplier that multiplies said first electrical signal by said delayed second electrical signal according to said predetermined value to produce a third electrical signal corresponding to a third spot having an effective diameter less than the diameters of said first and said second spots, the diameter of said third spot being variable by adjusting said time delay element.

[c73] 73. The apparatus recited in claim 72, wherein the time delay of said time delay element is adjustable.

[c74] 74. The apparatus recited in claim 72, wherein the time delay said delayed second electrical signal is based on the linear speed of said track, a distance between
said first spot and said second spot on said track, and a selected amount of waveform coincidence.

[c75]
75. The apparatus recited in claim 72, wherein said optical pickup comprises:
(a)a light source for emitting a laser beam;
(b)a diffraction grating disposed in the path of said laser beam for splitting said laser beam into a center and two outer beams, said diffraction grating positioned to cause said two outer beams to straddle said track;
(c)an optical mechanism disposed in the paths of said center and two outer beams for splitting said center and two outer beams into two sets of three beams, said optical mechanism aligned to split said two sets of three beams

tangentially along said track.

[c76] 76. The apparatus as recited in claim 75, wherein said optical mechanism comprises a BLAZE grating.

[c77] 77. A method for reading information encoded on a surface of an optical medium comprising:
(a)impinging a first read beam forming a first spot on a track;
(b)impinging a second read beam forming a second spot on the track, said second spot being proximate said first spot;
(c)generating a first electrical signal associated with a reflected portion of said first spot;
(d)generating a second electrical signal associated with a reflected portion of said second spot, said first and second electrical signals having a time delay therebetween based on a relative velocity and distance between said first spot and the second spot with respect to the surface of the optical medium, said second electrical signal being earlier in time than said first electrical signal;
(e)delaying said second electrical signal by a predetermined value, thereby resulting in a delayed second electrical signal; and
(f)multiplying said first electrical signal by said delayed second electrical signal to produce a third electrical signal corresponding to a third spot having an effective diameter less than the diameters of said first and said second spots, respectively.

[c78] 78. The method recited in claim 77, wherein the diameter of said third spot is variable by adjusting said time delay.

[c79] 79. A method for reading information on a rotating optical medium, comprising:
reading adjacent optically encoded positions along a track on said rotating optical medium;
generating a leading and a lagging electrical signal in response thereto;
delaying said leading electrical signal to at least partially coincide with said lagging electrical signal; and
combining said delayed leading electrical signal with said lagging electrical signal to produce a combined electrical signal in response to an overlap

between said delayed leading electrical signal with said lagging electrical signal.

[c80] 80. The method as recited in claim 79, wherein said step of reading further comprises:
using a light source to direct a first and a second beam of light onto adjacent locations on said track;
positioning a first and a second optical sensor to detect a reflection of said first and second beams of light; and
producing a leading electrical signal and a lagging electrical signal which are proportional to an amount of light detected within said first and second beams.

[c81] 81. The method as recited in claim 80, wherein said step of using comprises:
outputting a laser light beam with a laser light source;
splitting said laser light beam with a diffraction grating into a central read beam and a peripheral tracking beam;
splitting said read beam tangentially along said track into two separate read beams using an optical mechanism; and
focusing said separate read beams onto nearby locations within said track using an objective.

[c82] 82. The method as recited in claim 81, wherein said optical mechanism comprises a BLAZE grating.

[c83] 83. The method as recited in claim 81, further comprising:
using a beam splitter positioned between said optical mechanism and said objective to direct a portion of the optical energy from all of said beams toward said objective; and
coupling said beam splitter to the reflection of all of said beams.

[c84] 84. The method as recited in claim 79, wherein said step of reading comprises:
using optical sensors.

[c85] 85. The method as recited claim 84, wherein said optical sensors comprise photosensitive arrays.

[c86] 86. The method as recited in claim 85, wherein said photosensitive arrays

comprise photodiodes.

[c87] 87. The method as recited in claim 79, wherein said step of delaying further comprises:
adapting an electronic delay circuit to output an electrical signal as a temporally shifted received electrical signal.

[c88] 88. The method as recited in claim 87, wherein an amount of temporal shift created by said electronic delay circuit is adjustable.

[c89] 89. The method as recited in claim 88, wherein said temporal shift is responsive to a receipt of a delay selection input.

[c90] 90. The method as recited in claim 79, wherein said step of combining further comprises:
adapting a multiplier circuit to output an electrical signal in response to an overlap of said delayed leading electrical signal with said lagging electrical signal.